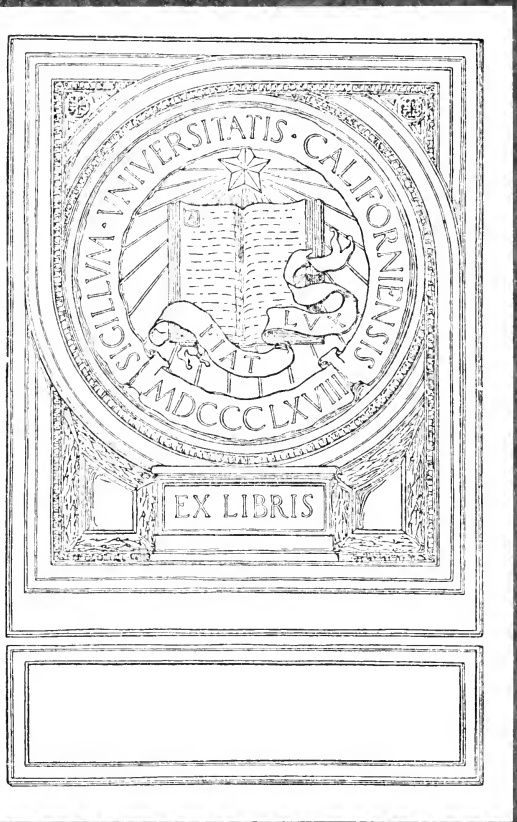
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Teachers College Bulletin


# SCORE CARD FOR CITY SCHOOL BUILDINGS

BY

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## INTRODUCTION

Large sums of money have been spent, and still larger amounts must be made available, for the housing of school children in the United States. In communities in which school accommodations are in use which were provided a generation or more ago, there needs to be a careful survey with a view to reconstruction or abandonment of buildings that are at present unfit for the purpose for which they are used. The ordinary observer is apt to think of a building as good or poor in terms of some particular part of the building with which he is familiar. There is need for much more careful scrutiny and evaluation of each one of the elements which goes to make up a satisfactory school plant.

Some years ago the authors of "Standards for City School Buildings," which appear in this document, began to develop a score card and standards for the measurement of school buildings. Growing out of an experience in evaluating more than a thousand school buildings and in the careful study of school building standards, there have been developed a score card upon which is recorded the number of points out of a thousand assigned to any particular building and this statement of standards. The score card and the accompanying standards have been used to advantage for two separate purposes:—first, the scoring of school buildings in the light of a school building program to be developed by a city, and second, in the checking of plans for new school buildings.

In measuring the school buildings which are to be found in any community, a high degree of reliability is secured by having three judges who score the building separately. Their scores are reported and the median for each of the major items on the score card becomes the score which is finally accepted for the building measured. An illustration of the results secured from three competent scorers, all of whom were familiar with the standards involved, is given on page 4 in the measurement of two buildings from the city of St. Paul that were scored by three individuals separately and then a combined score made up of the medians as suggested above.

## SCORES ALLOTTED TO TWO SCHOOL BUILDINGS BY THREE JUDGES

| | Hawthorne | | | | | Van Buren | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Scorer's No. | 6 | 9 | 12 | Median | | 8 | 9 | 10 | Median | |
| Item I..... | 85 | 71 | 83 | | 83 | 90 | 88 | 111 | | 93 |
| A..... | 45 | 30 | 45 | 45 | | 45 | 40 | 51 | 45 | |
| B..... | 20 | 26 | 23 | 23 | | 25 | 28 | 30 | 28 | |
| C..... | 20 | 15 | 15 | 15 | | 20 | 20 | 30 | 20 | |
| Item II..... | 94 | 113 | 91 | | 101 | 81 | 98 | 80 | | 88 |
| A..... | 15 | 22 | 16 | 16 | | 20 | 22 | 22 | 22 | |
| B..... | 44 | 36 | 26 | 36 | | 34 | 35 | 26 | 34 | |
| C..... | 35 | 55 | 49 | 49 | | 27 | 41 | 32 | 32 | |
| Item III..... | 116 | 123 | 115 | | 125 | 149 | 148 | 119 | | 135 |
| A..... | 31 | 32 | 30 | 31 | | 32 | 60 | 27 | 32 | |
| B..... | 0 | 8 | 9 | 8 | | 15 | 9 | 12 | 12 | |
| C..... | 13 | 15 | 16 | 15 | | 12 | 16 | 17 | 16 | |
| D..... | 0 | 0 | 0 | 0 | | 9 | 1 | 6 | 6 | |
| E..... | 5 | 15 | 15 | 15 | | 15 | 4 | 9 | 9 | |
| F..... | 15 | 2 | 5 | 5 | | 19 | 10 | 13 | 13 | |
| G..... | 42 | 41 | 35 | 41 | | 40 | 43 | 26 | 40 | |
| H..... | 10 | 10 | 5 | 10 | | 7 | 5 | 9 | 7 | |
| Item IV..... | 174 | 186 | 187 | | 179 | 171 | 154 | 178 | | 173 |
| A..... | 35 | 25 | 25 | 25 | | 20 | 10 | 15 | 15 | |
| B..... | 49 | 67 | 60 | 60 | | 46 | 64 | 57 | 57 | |
| C..... | 47 | 50 | 56 | 50 | | 60 | 30 | 53 | 53 | |
| D..... | 20 | 20 | 16 | 20 | | 10 | 10 | 15 | 10 | |
| E..... | 23 | 24 | 30 | 24 | | 35 | 40 | 38 | 38 | |
| Item V..... | 111 | 78 | 75 | | 85 | 70 | 80 | 61 | | 80 |
| A..... | 45 | 28 | 35 | 35 | | 30 | 27 | 8 | 27 | |
| B..... | 28 | 13 | 10 | 13 | | 25 | 19 | 18 | 19 | |
| C..... | 38 | 37 | 30 | 37 | | 15 | 34 | 35 | 34 | |
| Total.. | 580 | 571 | 551 | | 573 | 561 | 568 | 549 | | 569 |

Final score for Hawthorne Building..... 573

Final score for Van Buren Building..... 569

The need for checking against the school buildings as they exist at the present time is found in the scores allotted to school buildings in five surveys which have been carried out by the authors.

SCORES ALLOTTED TO SCHOOL BUILDINGS IN FIVE SURVEYS BY JUDGES USING THE STRAYER-ENGELHARDT SCORE CARD

ELEMENTARY SCHOOLS

| | Nassau County | Framingham | St. Paul | Omaha | Paterson |
|---|---|---|---|---|---|
| 300 or below | ..... | ..... | ..... | ..... | ..... |
| 301–500 | 1 | 2 | 9 | 16 | 12 |
| 501–600 | 1 | 14 | 23 | 17 | 6 |
| 601–700 | 7 | 1 | 13 | 10 | ..... |
| 701–800 | 12 | 1 | 3 | 8 | 3 |
| 801–900 | 13 | 1 | ..... | 1 | 3 |
| 901–1000 | 5 | ..... | 1 | ..... | 1 |
| Total | 39 | 19 | 49 | 52 | 25 |

HIGH SCHOOLS

| | | | | | |
|---|---|---|---|---|---|
| 300 or below | ..... | ..... | ..... | 1 | ..... |
| 301–500 | ..... | ..... | ..... | ..... | ..... |
| 501–600 | 1 | ..... | ..... | 2 | ..... |
| 601–700 | 1 | ..... | ..... | 1 | ..... |
| 701–800 | 5 | 1 | 1 | ..... | 1 |
| 801–900 | 7 | ..... | 3 | ..... | ..... |
| 901–1000 | 1 | ..... | ..... | ..... | ..... |
| Total | 15 | 1 | 4 | 4 | 1 |

A school building that scores less than five hundred points can seldom be reconstructed or repaired so as to make it a satisfactory school plant. In many of the cases given in the table above, the buildings in which children were housed were unsanitary and dangerous in the extreme. It is only as one undertakes a careful analysis of the situation, such as is suggested by the score card and by the standards which are contained in this pamphlet, that one can reasonably hope to present to the public the need for a program for school buildings

which may involve the abandonment of schoolhouses now in use and the erection of a very much better type of school plant.

Where school boards or school superintendents are asked to pass upon plans, the score card is of the utmost significance. As one takes each of the several items appearing on the score card and applies the standards which are suggested, he will often be surprised to discover that a plan which appears to be fairly satisfactory proves to involve a lack of appreciation of the standards of modern schoolhouse construction to a degree that ought to make any board of education or superintendent of schools ashamed to acknowledge his responsibility for it immediately after its construction.

From the experience that the authors have had in checking school plans with architects, it is entirely safe to say that they are only too glad to have the criticism that can be furnished in the light of the standards suggested before they complete their plans. They are as anxious as the school superintendent or the board of education to build a building that will be as nearly perfect as is possible. Where many buildings are to be scored, a set of these standards for each scorer should be provided and a score card for each separate building. There is, of course, a very great advantage in having as scorers those who are entirely familiar with the standards suggested and with the use of an instrument of this sort.

GEORGE D. STRAYER
N. L. ENGELHARDT

CITY SCORE CARD 1920

# THE STRAYER-ENGELHARDT SCORE CARD FOR CITY SCHOOL BUILDINGS

Published by
Bureau of Publications, Teachers College, Columbia University
New York City

The score card may be utilized in judging existing school buildings and grounds or in rating the plans of proposed school buildings. A distinct advantage accrues from the use of the score card in that it fixes attention upon all the details of the building. The total score is the composite of the scores on all the individual items. The score card should only be used in conjunction with the bulletin which outlines the building standards which have been determined upon by the authors. The score on any subdivision is based on conditions found as contrasted with these standards. The score card may be used in making building surveys of school systems or as a filing record.

Name of school..... City..... State.....

Date..... Scorer.....

| | Enrollment for a 5-Year Period | | | | | Average Daily Attendance for a 5-Year Period | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | | | | | | | | | | |
| Boys | | | | | | | | | | |
| Girls | | | | | | | | | | |
| Total | | | | | | | | | | |

| | Original | First Addition | Second Addition | Total |
|---|---|---|---|---|
| Cost of Land and Grading | $ | $ | $ | $ |
| Length of Site | ft. | ft. | ft. | ft. |
| Width of Site | ft. | ft. | ft. | ft. |
| Area of Site | sq. ft. | sq. ft. | sq. ft. | sq. ft. |
| Cost of Building Construction | $ | $ | $ | $ |
| Cost of Furniture and Equipment | $ | $ | $ | $ |
| Cost of Architect's Fees | $ | $ | $ | $ |
| Year of Construction | | | | |
| Length of Building | ft. | ft. | ft. | ft. |
| Width of Building | ft. | ft. | ft. | ft. |
| Area occupied by Building | sq. ft. | sq. ft. | sq. ft. | sq. ft. |
| Height of Building | ft. | ft. | ft. | ft. |
| Cubiture of Building | cu. ft. | cu. ft. | cu. ft. | cu. ft. |
| Cost per Cubic Foot | $ | $ | $ | $ |
| Chief Material Used | | | | |
| Number of Stories | | | | |
| Type of Building | | | | |
| Roof | | | | |
| Length of Playground | ft. | ft. | ft. | ft. |
| Width of P ayground | ft. | ft. | ft. | ft. |
| Area of Playground | sq. ft. | sq. ft. | sq. ft. | sq. ft. |
| Playground Area per Child A. D. A. | sq. ft. | sq. ft. | sq. ft. | sq. ft. |

**Accessibility:** Percentage of patrons residing within 1 mile radius.....

From 1–2 mile radius..... From 2–3 mile radius..... Above 3 miles from school.....

Percentage of Site Used For:

| Lawns and Landscapes | Buildings | Recreation | Gardening | Total |
|---|---|---|---|---|
| % | % | % | % | % |

Name the kinds of playground apparatus and number of each.....

List the attractive features of the environment.....

The unattractive and unsanitary features.....

**Entrances:** Number of..... Type..... Condition.....

Number of Rooms Facing:

| S. E. | East | S. W. | West | South | N. E. | North | N. W. | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**Gross Structure:**

Foundation..... Walls..... Doors open..... Condition.....

| Stairways | No. | Fireproof | Materials | Height of riser | Width of tread | Length of tread | No. of treads | No. of hand rails | Maximum capacity of: |
|---|---|---|---|---|---|---|---|---|---|
| To Basement | | | | | | | | | Basement |
| To Second Floor | | | | | | | | | Second Floor |
| To Third Floor | | | | | | | | | Third Floor |



Copies of this Score Card may be obtained from the Bureau of Publications, Teachers College, New York City.

What use is made of basement? .....

Distance from basement floor to ground level .....ft. Is roof-space provided?..... How used?.....

| Corridors | Width | Length | Natural light | Artificial light | Used as Cloakrooms | Obstructions | Color scheme |
|---|---|---|---|---|---|---|---|
| Basement | | | | | | | |
| First Floor | | | | | | | |
| Second Floor | | | | | | | |
| Third Floor | | | | | | | |

Check kind of **Heating System:** Hot air furnace.....Steam boiler.....Hot water boiler.....Is it reported satisfactory.....By whom.....
.....List the rooms which cannot be satisfactorily heated .....

What are the causes of unsatisfactory heating.....

Is thermostatic control provided.....Date of last official boiler inspection.....

Check kind of **Ventilating System:** Natural circulation.....Window ventilators.....Gravity system without exhaust accelerators..... Gravity system with exhaust accelerators.....Mechanically furnished fresh air supply..... Mechanical exhaust of foul air..... Is the system reported satisfactory.....
By whom..... List the rooms not satisfactorily ventilated .....

.....

Distance of cold-air inlet from ground.....Date of last cleaning of plenum chamber.....Air washer.....
Humidifier.....Condition.....

**Fire Protection:** List the rooms in which any of the following fire apparatus is found: Fire extinguishers.....
Date of last filling.....Fire hose.....
Automatic sprinkler..... Is building fireproof.....Basement isolated from first floor.....Basement ceiling fireproof.....
Heating apparatus in fireproof enclosure.....Combustible and inflammable material stored in building.....

| | | | | | |
|---|---|---|---|---|---|
| Dates of last 5 fire drills | | | | | |
| Time required to empty building | | | | | |

Are outer doors locked during school hours.....Fire alarm system: Automatic....., special signal.....gong.....Special fire exits.....
How indicated.....Fire escapes: open....., enclosed tower..... Location.....
No. of exits in building.....No. of exits with panic bolts.....Has basement an outside exit..... List the important location where doors open inward .....

**Janitor's Service:** Does janitor remain on premises during school hours.....Method of cleaning: Dry sweeping .....Vacuum cleaner.....
Frequency of mopping.....Sweeping compound used.....Oiled floors..... Frequency of cleaning.....
Before school hours.....After school hours.....During school hours.....How long before or after..... Dusting.....
Dry cloth.....Oiled cloth.....Not at all..... What evidences of efficient service prevail.....

.....

Check type of **Artificial Lighting System** used: Gas.....Electricity..... Check whether lighting is direct..... indirect.....or semi-indirect.....Number of electric outlets in classrooms..... In corridors..... Is artificial light provided in toilets.....
Adequacy..... In what necessary places is artificial light not provided?.....

.....

**Electric Service:** Telephone..... Bells.....

**Water Supply:** Name locations of drinking fountains .....

.....

Are these fountains sanitary.....In good operating condition.....Number of washbowls..... Location.....
.....Soap provided.....Towels..... Kind.....Hot water.....Baths..... Kind.....
Location.....
Date of last scientific testing of water supply ..... Results.....

**Toilet Systems:** List location of boys' toilets.....
Girls' toilets.....
Sanitary condition.....No. of boys' toilet seats.....Urinals..... No. of girls' toilet seats.....Toilet provisions for teachers.....
Janitor.....Arrangement..... Type of seats.....Arrangement.....
Type of urinals.....Arrangement.....Seclusion.....

| Name of room or part of building. | Repairs needed |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## DETAILS OF THE CLASSROOMS

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Room No. | | | | | | | | | | | | | | | | | | | | | |
| 2. Grade | | | | | | | | | | | | | | | | | | | | | |
| 3. Pupil capacity | | | | | | | | | | | | | | | | | | | | | |
| 4. Pupil enrollment | | | | | | | | | | | | | | | | | | | | | |
| 5. Dimensions Length, ft | | | | | | | | | | | | | | | | | | | | | |
| 6. Width, ft | | | | | | | | | | | | | | | | | | | | | |
| 7. Height, ft | | | | | | | | | | | | | | | | | | | | | |
| 8. Floor area, sq. ft | | | | | | | | | | | | | | | | | | | | | |
| 9. Area per child of pupil capacity | | | | | | | | | | | | | | | | | | | | | |
| 10. Area per child of enrollment | | | | | | | | | | | | | | | | | | | | | |
| 11. Area per child, with 40 in class | | | | | | | | | | | | | | | | | | | | | |
| 12. Total cubical contents, cu. ft | | | | | | | | | | | | | | | | | | | | | |
| 13. Cu. ft. per child of pupil capacity | | | | | | | | | | | | | | | | | | | | | |
| 14. Cu. ft. per child of enrollment | | | | | | | | | | | | | | | | | | | | | |
| 15. Cu. ft. per child, with 40 in class | | | | | | | | | | | | | | | | | | | | | |
| 16. No. of windows on front | | | | | | | | | | | | | | | | | | | | | |
| 17. left | | | | | | | | | | | | | | | | | | | | | |
| 18. rear | | | | | | | | | | | | | | | | | | | | | |
| 19. right | | | | | | | | | | | | | | | | | | | | | |
| 20. No. of windows size x | | | | | | | | | | | | | | | | | | | | | |
| 21. x | | | | | | | | | | | | | | | | | | | | | |
| 22. x | | | | | | | | | | | | | | | | | | | | | |
| 23. x | | | | | | | | | | | | | | | | | | | | | |
| 24. Window glass area—sq. ft | | | | | | | | | | | | | | | | | | | | | |
| 25. Ratio of window area to floor area | | | | | | | | | | | | | | | | | | | | | |
| 26. Width of mullions—inches | | | | | | | | | | | | | | | | | | | | | |
| 27. Distance—first window to front wall | | | | | | | | | | | | | | | | | | | | | |
| 28. Height of windows from floor | | | | | | | | | | | | | | | | | | | | | |
| 29. Height of windows from desk tops | | | | | | | | | | | | | | | | | | | | | |
| 30. Distance—window top to ceiling | | | | | | | | | | | | | | | | | | | | | |
| 31. Clock | | | | | | | | | | | | | | | | | | | | | |
| 32. No. of adjustable desks | | | | | | | | | | | | | | | | | | | | | |
| 33. No. of non-adjustable desks | | | | | | | | | | | | | | | | | | | | | |
| 34. No. of sizes of non-adjustable desks | | | | | | | | | | | | | | | | | | | | | |
| 35. No. of electrical outlets | | | | | | | | | | | | | | | | | | | | | |
| 36. No. of gas outlets | | | | | | | | | | | | | | | | | | | | | |
| 37. Finish of walls | | | | | | | | | | | | | | | | | | | | | |
| 38. Color of walls | | | | | | | | | | | | | | | | | | | | | |
| 39. Type of blackboards | | | | | | | | | | | | | | | | | | | | | |
| 40. Height of blackboards from floor | | | | | | | | | | | | | | | | | | | | | |
| 41. Window shades—type | | | | | | | | | | | | | | | | | | | | | |
| color | | | | | | | | | | | | | | | | | | | | | |
| 42. Book closet | | | | | | | | | | | | | | | | | | | | | |

Had seats been adjusted ..... When last done .....

Were shades being properly used .....

Other equipment of classrooms .....

.....

Cloakrooms: Accessibility ..... Equipment .....

Adequacy ..... Control .....

Special rooms: Kind and adequacy .....

.....

.....

.....

## SCORE CARD FOR CITY SCHOOL BUILDINGS

### Score of Building

| | 1 | 2 | 3 |
|---|---|---|---|
| I—Site | | | 125 |
| A. Location | | 55 | |
| 1. Accessibility | 25 | | |
| 2. Environment | 30 | | |
| B. Drainage | | 30 | |
| 1. Elevation | 20 | | |
| 2. Nature of soil | 10 | | |
| C. Size and Form | 40 | 40 | |
| II—Building | | | 165 |
| A. Placement | | 25 | |
| 1. Orientation | 15 | | |
| 2. Position on site | 10 | | |
| B. Gross Structure | | 60 | |
| 1. Type | 5 | | |
| 2. Material | 10 | | |
| 3. Height | 5 | | |
| 4. Roof | 5 | | |
| 5. Foundations | 5 | | |
| 6. Walls | 5 | | |
| 7. Entrances | 10 | | |
| 8. Aesthetic balance | 5 | | |
| 9. Condition | 10 | | |
| C. Internal Structure | | 80 | |
| 1. Stairways | 35 | | |
| 2. Corridors | 20 | | |
| 3. Basement | 15 | | |
| 4. Color Scheme | 5 | | |
| 5. Attic | 5 | | |
| III—Service System | | | 280 |
| A. Heating and Ventilation | | 70 | |
| 1. Kind | 10 | | |
| 2. Installation | 10 | | |
| 3. Air supply | 15 | | |
| 4. Fans and motors | 10 | | |
| 5. Distribution | 10 | | |
| 6. Temperature control | 10 | | |
| 7. Special provisions | 5 | | |
| B. Fire Protection System | | 65 | |
| 1. Apparatus | 10 | | |
| 2. Fireproofness | 15 | | |
| 3. Escapes | 20 | | |
| 4. Electric wiring | 5 | | |
| 5. Fire doors and partitions | 10 | | |
| 6. Exit lights and signs | 5 | | |
| C. Cleaning System | | 20 | |
| 1. Kind | 5 | | |
| 2. Installation | 5 | | |
| 3. Efficiency | 10 | | |
| D. Artificial Lighting System | | 20 | |
| 1. Gas and electricity | 5 | | |
| 2. Outlets and adjustment | 5 | | |
| 3. Illumination | 5 | | |
| 4. Method and fixtures | 5 | | |
| E. Electric Service System | | 15 | |
| 1. Clock | 5 | | |
| 2. Bell | 5 | | |
| 3. Telephone | 5 | | |

| | 1 | 2 | 3 |
|---|---|---|---|
| F. Water Supply System | | 30 | |
| 1. Drinking | 10 | | |
| 2. Washing | 10 | | |
| 3. Bathing | 5 | | |
| 4. Hot and cold | 5 | | |
| G. Toilet System | | 50 | |
| 1. Distribution | 10 | | |
| 2. Fixtures | 10 | | |
| 3. Adequacy and arrangement | 10 | | |
| 4. Seclusion | 5 | | |
| 5. Sanitation | 15 | | |
| H. Mechanical Service System | | 10 | |
| 1. Elevator | 5 | | |
| 2. Book-lifts | 2 | | |
| 3. Waste-chutes | 3 | | |
| IV—Class Rooms | | | 290 |
| A. Location and Connection | 35 | 35 | |
| B. Construction and Finish | | 95 | |
| 1. Size | 25 | | |
| 2. Shape | 15 | | |
| 3. Floors | 10 | | |
| 4. Walls | 10 | | |
| 5. Doors | 5 | | |
| 6. Closets | 5 | | |
| 7. Blackboards | 10 | | |
| 8. Bulletin board | 5 | | |
| 9. Color scheme | 10 | | |
| C. Illumination | | 85 | |
| 1. Glass area | 45 | | |
| 2. Windows | 30 | | |
| 3. Shades | 10 | | |
| D. Cloakrooms and Wardrobes | 25 | 25 | |
| E. Equipment | | 50 | |
| 1. Seats and desks | 35 | | |
| 2. Teacher's desk | 10 | | |
| 3. Other equipment | 5 | | |
| V—Special Rooms | | | 140 |
| A. Large Rooms for General Use | | 65 | |
| 1. Playroom | 10 | | |
| 2. Auditorium | 15 | | |
| 3. Study hall | 5 | | |
| 4. Library | 10 | | |
| 5. Gymnasium | 10 | | |
| 6. Swimming pool | 5 | | |
| 7. Lunch room | 10 | | |
| B. Rooms for School Officials | | 35 | |
| 1. Officers | 10 | | |
| 2. Teachers' room | 10 | | |
| 3. Nurse's room | 10 | | |
| 4. Janitor's room | 5 | | |
| C. Other Special Service Rooms | | 40 | |
| 1. Laboratories | 20 | | |
| 2. Lecture rooms | 10 | | |
| 3. Store rooms | 5 | | |
| 4. Studios | 5 | | |
| Totals | 1000 | 1000 | 1000 |

**Instructions for Using Card** — (1) Basis for Scoring, 1000 points. **(2) For scoring three columns are allowed.** While actually at work on a building only the first need be filled out, the second and third to be filled out at leisure. (3) Where credit is allowed for any single item not present and not needed in a building draw a circle around such credit. All scores should be recorded on the basis of the standards outlined in the bulletin, The Strayer-Engelhardt Score Card for City School Buildings, Bureau of Publications, Teachers College, Columbia University, N. Y.

# STANDARDS FOR CITY SCHOOL BUILDINGS

ARRANGED TO BE USED IN CONNECTION WITH THE STRAYER-ENGELHARDT SCORE CARD FOR CITY SCHOOL BUILDINGS

---

I. SITE

A. LOCATION:

1. Accessibility:

The geographical center of the district, the center of population, and types of roads leading to the school should be fully considered. A junior or senior high school building should be reasonably central to its contributary schools, or to the high school population it accommodates. Location may be sacrificed in the interest of adequate size and environment.

2. Environment:

*a.* Gardens, trees, shrubbery in vicinity and on grounds are desirable.

*b.* Buildings and hills, if not too near, are desirable as windbreaks. The skyline should not have an angle of more than 30 degrees from base of building. It is generally accepted that the distance of the school building from the obstructing buildings or trees ought not to be less than twice their height.

*c.* Nearness of non-fireproof buildings becomes a source of danger. The neighborhood of railroad crossings and intersecting carlines should be avoided.

*d.* The vicinity of sources of immoral influences should be avoided.

*e.* Freedom from noises, dust, dangers, polluted air, and malodors should be sought.

B. DRAINAGE:

1. Elevation:

*a.* Freedom from surface drainage of contiguous ground, especially if such ground is exposed or has been recently exposed to pollution of any kind.

*b.* If built on flat ground, tile drainage may be needed underneath cellar as well as about the grounds. Depth of tile should be determined by the character of the soil.

*c.* Where the contour of land makes it possible, the site should be located on high land. Abrupt differences in grade, which might appear to be disadvantageous, often furnish the very opportunity for a commanding setting of the building. Low ground should be avoided wherever possible. High land removed from manufactories, stables, dumps, swampy places, and other objectionable surroundings should be sought.

2. Nature of soil:
   *a.* The soil should be non-erosive. Sandy loam is best with 15-25% sand.
   *b.* Natural ground should be chosen in preference to artificially constructed land. Possible contamination of the soil and its accompanying menace to the health of children are sufficient reasons for avoidance of the latter.
   *c.* The playground section should be dry and pervious. It should be constructed to drain very rapidly and should have a top layer of gravel or finely crushed stone on those sections reserved for playground apparatus and for minor games.

C. Size and Form:

The site should be large enough and of good shape to allow for the proper placing of building.

The playground, exclusive of athletic field and gardens, should provide a minimum of 100 square feet per child. The playground should also have adequate playground equipment.

Provision should be made for a flagstaff on the school grounds in front of all school buildings. It should be at least 40 feet high and provided with halliards, truck, etc., complete. A suitable receptacle for the safekeeping of the flag when not in use should be provided within the school building.

II. BUILDING

A. Placement:

1. Orientation:

The orientation should be such as to provide light to the main classrooms preferably from the southeast and east. Southeast, east, southwest, west, and south are the best order of compass points in orientation. North light shall be avoided except for studios or other special types of rooms.

2. Positions on site:
   *a.* The building should be placed for maximum aesthetic effect.
   *b.* It should not be too near noisy streets nor face unsightly buildings.
   *c.* The position of the building should be such as to permit of maximum utilization of playgrounds.
   *d.* Future additions should be made possible in the placing so that serious inroads shall not be made into the playground.

B. Gross Structure:

1. Type:

The building should be elastic in nature, and should permit of the expansion of any one of its departments. It should be so planned that additions will not impair the natural lighting of its rooms. Open types of buildings in T, H, E, U, or similar shapes, are most desirable.

DEFINITIONS:

For construction purposes, the American Institute of Architect has grouped buildings under five types as follows:

Type A—A building constructed entirely of fire resistive materials, including its roof, windows, doors, floors, and finish.

Type B—A building of fire resistive construction in its walls, floors, stairways, and ceilings, but with wood finish, wood or composition floor surface, and wood roof construction over fire resistive ceiling.

Type C—A building with masonry walls, fire resistive corridors and stairways, but with ordinary construction otherwise, *i. e.,* combustible floor, partitions, roofs, and finish.

Type D—A building with masonry walls, but otherwise ordinary or joist construction and wood finish.

Type E—A frame building constructed with wood above foundation, with or without slate or other semi-fireproof material on roof.

2. Material:

Hardburned brick or concrete are standard materials for construction of types A, B, and C. Terra cotta and stone are also acceptable.

3. Height:

No school building, except in very congested cities, should be approved which is planned for more than two stories above the basement. A basement should not reach more than three and one-half feet below ground level, except where used for the heating plant, etc. Stories more than sixteen (16) feet high, measuring from floor to ceiling, should be rated as two stories. No school building of type D and E construction should be approved when it is planned for more than one story.

4. Roof:

Such materials as slate, asbestos, shingle, and tile are standard for high sloping roofs. Flat roofs are more economically constructed than pitch roofs, and when properly sloped for drainage cause litttle expense for maintenance.

*a.* High pitch roofs should be provided with metal snow-guards.

*b.* Flat roofs may be constructed of pitch and slag, asphalt, or tile.

*c.* Eaves gutters, where needed, and leaders should be provided.

5. Foundation:

*a.* The foundation should be made of hardburned brick, stone, or concrete (reinforced, when necessary), with wide footing.

*b.* Foundations exposed in any excavated part of the basement should be made waterproof and damp-proof.

6. Walls:
   *a.* Outer and interior bearing walls of hard brick laid in cement, mortar, stone, or concrete are standard for building types A, B, and C; wood for types D and E.
   *b.* Interior non-bearing walls should be of hollow tile or plaster block for types A, B, and C; timber for types C, D, and E.
   *c.* All outside walls should be furred.

7. Entrances:
   Number:
   *a.* One wide entrance at the middle of the main axis.
   *b.* Secondary entrances with double doors should be near the stair landings at the intersections of the main and secondary corridors.
   *c.* One entrance should lead directly from the playgrounds to the gymnasium or playroom.
   *d.* One entrance should lead directly to the heating system.
   *e.* Enclosed fireproof stairways and fire escapes should have separate exits.
   *f.* All entrances should be free from outside obstructions.
   *g.* Separate entrance for kindergarten and manual training are desirable.
   *h.* Steps:
      (1) As few as possible and non-exposed.
      (2) Of stone or concrete, with a non-slipping surface.
      (3) A 6-inch riser and a 12-inch non-slipping tread are desirable standards to be maintained.
   *i.* Vestibules:
      (1) A width of 10-12 feet is desirable for the main vestibule. Secondary vestibules should have a width which is not less than that of their corridors.
      (2) Double swing doors, with upper portion glazed with clear wire glass, and waterproof floors, should be provided.
   *j.* Doors:
      (1) Two pairs of double doors, opening outward, should be provided for the main entrance.
      (2) The doors should be substantial but not too heavy for children to swing with ease.
      (3) They should be provided with fire or panic bolts which permit of their opening by throwing the weight of the body against them. Door checks and foot stops, or permanent catches, to hold doors open, should be provided.
      (4) The size of outer doors should not be less than 3 feet by 7 feet.

8. Aesthetic balance:
   *a.* The building should be symmetrical and pleasing to the eye.
   *b.* Variations in construction that add to the appearance are to be desired rather than those that add to the cost.

*c.* Extensive and costly ornamentation, which does not add to utility, should be avoided.

C. INTERNAL STRUCTURE:

1. Stairways:

*a.* Construction:

(1) Fireproofness should be required for all stairways. Stairways should be separated from corridors by fire glass doors and absolutely fireproofed from the remainder of the building with self-closing fire doors at each story. No stairway should be approved which is not continuous from the grade line to the second story. No well holes should be allowed between runs of stairs.

(2) The material should be steel frame or reinforced concrete, with treads of slate or cement. Handrails on both sides should be of metal; center rails should be continuous, and wall rails should be turned into the walls at ends. Two sets of rails on balustrade and wall should be provided to meet the needs of the varying sizes of children. All treads should be made non-slipping. Central balustrade grill should be about five feet high and be made solid at bottom for a distance of 12-15 inches.

(3) Dimensions: Width 5 feet; 10-12-inch tread; 6-7-inch riser. No stairway should be more than five feet in width, nor less than four feet measuring between the handrails. Stairways should always be in two runs from story to story and should have broad landings. In monumental stairways, where an entrance of more than eight feet in width is desired, substantial center handrails should be provided.

(4) Landing: Width equal to length of the longest tread in stairs leading to it. Winders in stairways should not be approved except for circular stairs to gymnasium, gallery, or to attic or similar places where use is limited.

*b.* Number:

Stairways should be sufficient in number to empty the building in three minutes or less, on basis of actual determination for each building using the rule that 120 pupils in line, two abreast, can pass a given point in one minute. It must be borne in mind, in the planning of stairways, that all the stairways of a building do not always become available in the case of fire. It may happen that one stairway is blocked by the fire itself. Such possibilities should be considered in building planning. No two-story building should have less than two stairways. Buildings having nine or more rooms on the second floor should have more than two stairways.

*c.* Location:
Stairways should be located on outer walls, leading directly to exits. They should be accessible to the main and secondary corridors. They should provide for safety, rapid circulation, and a minimum of travel distance between the various parts of the building.

*d.* No closet for storage purposes should be placed under any stairway.

*e.* No door should open directly upon a stairway, but should open on a platform or landing equal in length to the width of the door.

*f.* Lighting:
Good provision for natural as well as artificial lighting should be made. Switches for lights should be near exits. Gas lights on stairways and at exits are recommended where installation is possible.

*g.* Sanitation:
Stairways should have sanitary coves and be free from dust-catching corners and ledges.

*h.* They should be soundproof.

2. Corridors:

*a.* The location is determined by the position of the classrooms and special rooms. They should provide ready access to stairways and permit rapid circulation to every part of the building.

*b.* Construction:

(1) The material should be fireproof, noiseless, and durable. Cement, overlaid with composition floor or battleship linoleum, is most desirable. Hard maple and hard pine are the woods best adapted for corridor floors.

(2) They should be wide enough to prevent congestion and wide enough for decoration. In elementary schools the main corridor should be 10-12 feet wide; others not less than 8 feet wide. In high schools the main corridor should be 12-14 feet wide; secondary corridors 10 feet wide.

(3) Classroom and special room doors should open into corridors.

(4) Adequate natural lighting should be provided in all corridors. Secondary natural light should be provided where necessary.

*Optional:* Sanitary coves free from dust catchers should be provided in corridors.

*c.* The corridors should be free from lockers, cases, pedestals, and the like, where they interrupt the passage to exits or stairways.

*d.* Aesthetic balance:
Provisions should be made for influencing children with beautiful surroundings — pictures, busts, friezes, and the like.

3. Basement:

*a.* That section of the basement floor which is used for instructional purposes should not be placed at a depth of more than three and one-half feet below grade. Boiler rooms, ventilating plant, and coal pits may be lower and at a height which will permit of the direct dumping of coal from the driveway. Ducts for the distribution of air to classrooms and other rooms may be enclosed in moisture-proof passages underneath the floor. Such ducts should not be permitted, when installed overhead, to reduce the height of the basement story below 12 feet. If the ducts cover more than 25% of the ceiling, their height should be added to the height of the rooms in the planning of the basement.

*b.* Heating and ventilating departments should be separated from the rest of the basement by fireproof walls. Self-closing fireproof doors should be provided at the openings. Boiler and fuel rooms should be separated, but accessible to each other.

*c.* Basement floor and walls should be waterproofed.

*d.* The basement should have window surface equal to approximately 20% of the floor area, where used for instructional or social purposes.

*e.* A masonry wall between boys' and girls' toilets and baths should be provided where such rooms adjoin.

*f.* The adequacy of equipment of the heating, fuel, and ventilating departments should be given proper attention. Ash-cans, ash-hoists, lighting facilities for inspection of boilers, hot water heating apparatus, and fire hose should be stipulated as part of the equipment. The size and construction of the fuel room should be such as to permit of a storage of a year's supply of fuel and such as to make that supply accessible with a minimum of labor on the part of the janitor. In establishing the size of the fuel room, 35 cubic feet is considered necessary for the storage of each ton of coal.

*g.* Utilization of entire space in basement should be the aim. Ample janitor storage room, storage of window screens, doors, school desks, etc., storage for gymnasium equipment when it is placed in the basement, and industrial arts storage, should be provided. On the other hand, waste space and excessive storage rooms should be avoided.

4. Color scheme:

The color scheme of the basement rooms and corridors may be similar to that of classrooms and corridors of the other floors.

5. Attic:

The roof-space between ceiling and roof is merely an air chamber acting as insulator to prevent excessive heat and cold. It should not be utilized

for storage, but should be made accessible to the floor below through the medium of an iron stairway.

A section of the roof space should be set aside for the air-tight exhaust chamber where an exhaust system of ventilation is installed.

## III. SERVICE SYSTEMS

### A. Heating and Ventilating:*

1. Kind:

*a.* Five- to eight-room schools: The "Direct-Natural," "Direct-Gravity," "Direct-Mechanical," or "Indirect-Mechanical" systems, or acceptable combination thereof, only, are desirable.

*b.* Schools with more than eight classrooms: The "Direct-Mechanical" or "Indirect-Mechanical" systems, or acceptable combination thereof, only, are desirable.

Definitions:

Systems of heating and ventilation are here classified and designated by a compound word for each system. The word preceding the hyphen indicates the method of *heating,* and the word following the hyphen indicates the system of air supply *ventilation.*

Where the word "Direct" is applied to a heating system, it means that the heat is imparted directly to the room by means of radiating surfaces or heat sources located within the room heated. Steam and hot water radiators and electric heaters are appliances classified under this heading.

Where the word "Indirect" is used, it means that heat is imparted indirectly to the room by air initially warmed by radiating surfaces or heat sources located outside of the room heated and the warmed air is conveyed therefrom to the room through suitable air ducts or flues. Ventilating room heaters, hot air furnaces, and standard steam and hot water indirect radiators are appliances classified under this heading.

Where the word "Gravity" is applied to a ventilation system, it means that the required air movement is maintained by the force of gravity only, either with or without acceleration by means of an added source of heat. The capacity of a "Gravity" system should be determined upon the basis of a difference of indoor and outdoor temperature of forty (40) degrees Fahrenheit or less.

Where the word "Mechanical" is used, it means that the required air movement is maintained by the use of blowers, fans, or similar mechanically operated appliances.

1. "*Furnace-Gravity*" system includes the following:

*a.* Ventilating room heaters.

*b.* Hot air furnaces located in the basement and below the room or rooms to be heated.

* Original data for this section prepared by C. E. Pearce, M.E., member, American Society of Heating and Ventilating Engineers.

Both appliances (*a*) and (*b*) take the air from out of doors and deliver warm air to the rooms without the use of mechanical devices. Ducts or flues of proper size are provided. The air, in sufficient volume to ventilate the rooms, is heated to a temperature adequate to maintain the standards set up in these requirements. In addition, there is provided a corresponding gravity exhaust system, which withdraws vitiated air from the rooms and discharges it out of doors. The discharge may be effected with or without acceleration by means of an added source of heat.

2. "*Direct-Natural*" system means an equipment including direct radiators under the windows for heating the room and properly designed deflecting ventilators for the windows. These ventilators will allow the natural admission of the air from out of doors. A system of exhaust ventilation for the removal of vitiated air in the required volume, through specially located outlets in the room, should be required. Desirablity is based on the following rules:

   *a.* This system should not be used in assembly rooms.

   *b.* It should be used only in connection with a steam atmospheric vapor system of heating, with graduating control valves on the radiators.

   *c.* The radiators should extend the full width of all windows. All windows should be used for the admission of air to the room. Radiators should contain not less than twice the radiating surface otherwise necessary to maintain the required room temperature.

   *d.* Window deflecting ventilators, not less than twelve (12) inches high, should be placed on the sills and extend the full width of all windows. They should be of approved construction, insuring effective deflection and diffusion of the air without objectionable drafts.

   *e.* Vitiated air should be taken from each room through one or more openings located near the floor in the wall on the side of the room opposite from the window ventilators. If no accelerating heaters are placed in the exhaust flues, at least two such openings should be provided in each schoolroom. These openings should be spaced not less than eight (8) feet apart, center to center. Each opening should connect with an independent exhaust flue extending through the roof. The combined areas of such flues should be not less than one (1) square foot for each five occupants of the room. Each flue should be provided with a shut-off damper. For a mechanical exhaust, or for a gravity exhaust system having accelerating heaters in the flues, a single exhaust opening and flue for each room may be provided. This single opening should be located as above required.

3. "*Direct-Gravity*" system means an equipment including:

   *a.* Direct radiators located with the rooms to be heated.

   *b.* Indirect radiators, in suitable casings, located below the rooms to be ventilated.

The air is taken from out of doors over the indirect radiators and delivered to the rooms in sufficient volume and at approximately the required room-temperature, without the direct use of mechanical means. Ducts and flues of proper size are used for the delivery of air. Approved mechanical means are provided for auxiliary use when necessary. A corresponding gravity exhaust system, which withdraws the vitiated air from the rooms and discharges it out of doors, is installed. This exhaust system may be installed with or without acceleration by means of an added source of heat.

4. *"Direct-Mechanical"* system includes the following:
   *a.* The "split system," providing both direct radiators located within the rooms to be heated, and a forced air supply for rooms requiring ventilation. The forced air supply system should consist of a mechanically operated fan or blower, which takes the air from out of doors and draws or forces it through suitably enclosed air heaters. At these heaters it should be warmed to approximately room temperature and thence delivered to the rooms through properly proportioned ducts or flues.
   *b.* The "unit system." Such a unit system includes in each room one or more ventilating units which are located under the windows and which contain electrically operated twin multiblade fans, drawing the air directly from out of doors and delivering it to the room in the required volume. The ventilating unit also contains extended surface steam radiators for heating the air to the required temperature.

   In connection with either of the above systems a corresponding mechanical or gravity exhaust system is used. This exhaust system withdraws the vitiated air directly from the rooms and discharges it out of doors. The discharge may be with or without acceleration by means of an added source of heat.

5. The *"Indirect-Mechanical"* system includes no direct radiators within the school rooms, but provides for both the heating and ventilation of school rooms to the required standard by means of a forced system of air supply. A mechanically operated fan or blower is employed which takes the air from out of doors and draws or forces it through suitably enclosed steam or hot water indirect radiators or through hot air furnaces. When thus warmed to a sufficient temperature, the air is delivered to the classrooms through properly proportioned ducts or flues. A corresponding mechanical or gravity exhaust system for rooms requiring exhaust ventilation is used. This system provides for the withdrawal of the vitiated air from the rooms and its discharge out of doors. This system may be installed with or without acceleration by means of an added source of heat. The indirect-mechanical system requires, in addition, direct radiators sufficient to heat all rooms where water is provided and also direct radiators at all entrances.

6. *"Direct-Indirect"* ventilations:

The so-called "direct-indirect" system of heating and ventilation is not acceptable for any schoolroom. By "direct-indirect" is meant the introduction of air at the base, or upon any part, of a "direct" radiator without the use of a fan as provided in "unit systems."

2. Installation:

*a. Hot air furnaces:*

Of approved design, having fire pot and radiator entirely surrounded by insulated sheet metal casing or masonry enclosure. This enclosure should be so arranged that no perceptible resistance is encountered by the air in passing to the warm air leaders.

Should be provided with approved water evaporating pan located within the casing, preferably near the top.

Should be computed for size on the basis of:

(1) Total heat necessary for heating the building and warming the air for ventilation to standard temperature.

(2) The heating of fuel.

(3) The rate of combustion.

(4) The combined efficiency of furnace and grate.

The heating surfaces and grate area of the heater should be such that its rated and required capacity may be obtained without forcing under any conditions of service.

*b. Steam and hot water boilers:*

Should be constructed and equipped in accordance with the boiler rules of the American Society of Mechanical Engineers.*

Should be installed with sufficient space on all sides to allow of proper firing, adequate cleaning, and ready access to all parts for necessary repairs.

Should be computed for size on the basis of:

(1) The total connected heat radiating surface, including direct and indirect radiation, water heating coils, mains, and risers, each reduced to its equivalent of direct radiating surface.

(2) The available fuel charging capacity of the boiler fire pot.

The available fuel charge for any boiler should be sufficient to maintain the boiler rating for not less than eight (8) hours without replenishing when connected to not more than four thousand (4,000) square feet of equivalent direct steam radiating surface, or to not more than six thousand (6,000) square feet of equivalent direct water radiation. For larger connected loads the fuel charge should be sufficient to maintain the boiler rating for not less than six (6) hours without replenishing.

* Copies of these rules may be obtained from the Society, 29 West 39th Street, New York City.

c. *Direct radiators:*

Should be constructed of cast iron, having smooth surface. Coils should be constructed of wrought iron pipe and cast iron coil fittings.

Should be located under windows, wherever possible, except as provided in paragraphs (*c*) and (*d*) of this section. When so placed, radiators should not extend above the window stool. They should not be located under blackboards.

In stair halls which are used as fire exits, direct radiators should be located at a distance of more than six feet from the floor, the stair treads, or the stair landings.

Should be located not less than two (2) feet above the working water level in the boiler, if used on a steam gravity-return system.

When used without a system of indirectly warmed air supply, direct radiators should be computed for size on the basis of the total heat loss, under the required temperature, conditions, through all exposed glass, wall, roof, and floor surfaces, including one room air change per hour, or equivalent, as allowance for leakage.

When used in conjunction with a system of indirectly warmed air supply, direct radiators should be computed for size on the same basis as required above, but excluding allowance for air leakage. Such leakage should be provided for in the warmed air admitted for ventilation.

Where a "unit system" is used, direct radiation, in addition to the ventilating units, should be installed sufficient to heat the room as required above, unless the units are of ample size and so arranged as to allow direct heating of the room without the use of the fans.

When placed in enclosures, direct radiators should be increased in size over requirements of paragraphs above by not less than thirty per cent. Six (6) square inches of register area at top of radiator and four (4) square inches of register area at bottom of radiator, per square foot of radiation, should be provided. As a substitute, a grille over the entire front of the radiator, extending above the top of the radiator a distance equal to the depth of the radiator, may be used. Enclosures should be lined with galvanized iron and asbestos sheets. Easy access to valves should be provided.

d. *Indirect radiators:*

Should be constructed preferably of cast iron having extended surface, or may be made of wrought iron or steel pipe with suitable cast iron headers.

Should be encased in sheet metal, or other fireproof enclosures, to confine the flow of the air close to, and in contact with, the radiator sections.

Should be computed for size on the basis of:

(1) Required air volume.
(2) Required temperature rise.
(3) Free air space or efficiency of the radiator.
(4) Air velocity.

The velocity through the radiator should not exceed the necessary air velocity in the connecting warm air flues when used in a gravity air supply system. The velocity through the radiator should not exceed twelve hundred (1200) feet per minute when used as a central air tempering heater in a mechanical air supply system.

*e. Accelerating heaters:*

May be steam radiators, either hung in separate exhaust flues not more than twelve (12) inches above the highest opening in the flue, or placed in fireproof enclosures in roof space at the junction of several exhaust flues. When used in connection with a furnace gravity system, accelerating heaters may be stack heaters located at the base of the central exhaust flues. The use of hot water radiators as accelerating heaters is not desirable.

Should be computed for size on the basis of not less than two (2) square feet of steam-heated furnace for each one hundred (100) cubic feet of air per minute to be exhausted through the flues.

*f. Piping:*

Should be of ample capacity and properly arranged for the system of distribution used. Should have proper main control valves located at or near the boiler. Every stack of indirect radiation should be valved to allow of separate control. For large heating installations, the piping for direct radiation and indirect radiation should be arranged on separate systems. Each system should be properly valved to allow of separate operation. Piping installed under floors, in unexcavated spaces, or in earth, should be carefully protected against corrosion by being suitably painted and by being enclosed in approved tile or masonry conduits or trenches. Piping laid in cinder or concrete floor fill or construction should be protected by suitable heavy steel metal arches, or equivalent device. Ample space should be allowed for expansion and contraction of all concealed piping.

*g. Pipe and boiler covering:*

Should be made of approved non-conducting heat insulating materials in the form of sectional coverings for pipes carrying steam or hot water and plastic felting for pipe fittings and other hot surfaces.

Should be used on all main distribution piping and branches and on all piping inaccessibly concealed in the building construction or installed in locations liable to exposure to freezing temperature.

Should be applied to steam and hot water boilers and to furnaces when such heating appliances are not otherwise enclosed in masonry or specially insulated casings. Coverings should also be applied to all steam and hot water piping in boiler rooms located under occupied rooms.

*h. Flues and ducts:*

All ducts and flues used for conveying air for heating and ventilation should be constructed throughout of fireproof materials, having smooth interior surfaces and rendered tight against air leakage.

*i. Warm air riser flues:*

Should be individual flues for respective rooms served. The use of a common flue serving more than one room is not acceptable.

Should be computed for area when used in a gravity system of air supply on the basis of maximum allowable air velocity, as follows:

(1) For rooms on the first floor (above the heaters) 250 feet per minute.

(2) For rooms on the second floor (above the heaters) 300 feet per minute.

Should be computed for area, when used in a mechanical system of air supply, on the basis of maximum allowable velocity of four hundred (400) feet per minute.

*j. Exhaust air raiser flues:*

Should be individual flues for respective rooms served, with this exception—a common flue serving more than one room, other than rooms for class, study, recitation, or assembly, may be used provided every room exhaust connection thereto is supplied with an approved automatic fire damper.

Should be computed for area, when used in a gravity system of exhaust ventilation, on the basis of maximum allowable air velocity, as follows:

For flues 15 feet high or less, 200 feet per minute.
For flues 15 to 30 feet high, 250 feet per minute.
For flues 30 to 40 feet high, 300 feet per minute.
For flues 40 to 50 feet high, 350 feet per minute.

Should be computed for area, when used in a mechanical system of exhaust ventilation, on the basis of maximum allowable velocity of:

(1) Four hundred (400) feet per minute for individual flues,

(2) Six hundred (600) feet per minute for flues of over four (4) square feet area common to two or more rooms.

Should be carried through the roof, either as individual flues, or after being joined to a common flue at or near the roof level. Exhaust air riser flues may be connected by a system of lateral ducts to exhaust fans, centralized roof ventilator, central accelerating chambers, cupolas, or equivalent devices. In no case should exhaust flues discharge into open attic spaces.

Where carried through the roof, exhaust air riser flues should extend to, or above, the level of any adjacent copings or other raised portions of the roof. In all cases such extensions should be not less than three (3) feet above the roof.

Exhaust flues should be provided at top with approved caps, ventilator heads, or equivalent devices, to exclude the weather. Such devices should have on at least two opposite sides a free area of opening equal to not less than the area of the flue.

*k. Lateral ducts:*

Should be computed for area with reasonable reference to the velocity of the air carried in the riser flues to which they connect. The maximum allowable velocity in any lateral duct should be as follows:

(1) For a gravity system four hundred (400) feet per minute.

(2) For a mechanical system, using individual lateral ducts, eight hundred (800) feet per minute.

(3) For a mechanical system, using lateral trunk ducts twelve hundred, (1200) feet per minute.

*l. Smoke flue:*

(1) A separate smoke flue should be provided for the heating furnace or boiler. It should be constructed of fire-resisting materials throughout, having smooth interior surface. The flue, if unlined, should be constructed with brick walls not less than twelve (12) inches thick. If lined with tile, the brick walls should be not less than eight (8) inches thick. The smoke flue may consist of a steel stack enclosed by brick walls not less than twelve (12) inches thick. The smoke flue should extend not less than two (2) feet above the highest point of the roof or an equal distance above any roof copings.

(2) The smoke flue should be computed for minimum area in square feet for round or square flue based upon the area of the boiler or furnace grate in square feet divided by the square root of the total flue height in feet above the grate level, when large size anthracite and bituminous lump coal, oil, or gas is used as fuel. The area should be increased by twenty-five (25) per cent when small size anthracite or run-of-mine bituminous coal is used. For rectangular flue the relation of the sides should be not less than in the ratio of one to two.

*m. Registers and grilles:*

Should be approved cast iron, cut steel, or woven wire in wrought iron frames. They should have free air spaces in the face equal to not less than seventy (70) per cent of the gross area of openings in which they are placed.

Should be furnished for all air supply room openings. They may be omitted for air exhaust room openings, provided suitable shut-off dampers are installed in the connecting flues or ducts.

When used for openings connecting directly with vertical flues, they should have a height equal to not less than the depth of the flue, and preferably twenty-five (25) per cent greater.

Registers and grilles should be computed for net area on the basis of a maximum allowable velocity of three hundred (300) feet per minute for air supply registers when located fifteen (15) feet or less above the floor.

A maximum allowable velocity of four hundred (400) feet per minute for air exhaust registers and for air supply registers when located more than fifteen (15) feet above the floor..

The use of floor registers or grilles is not desirable.

*n. Dampers:*

Should be provided with approved operating, adjusting, or clamping devices as required for the service intended. When dampers are located in inaccessible positions, such devices should be extended to accessible points.

Should have approved means of indicating their open or closed position. When placed in locations remote from the room openings served, they should be plainly marked for identification.

Shut-off dampers, or equivalent device, should be provided at or near all points where fresh air is admitted to, or vitiated air discharged from, the building. They should be so arranged that such air passages may be closed when not in use. Such dampers should be capable of being set to regulate the air velocity when in use.

Volume dampers should be provided in all air supply and air exhaust ducts or flues so arranged as to allow of an equitable adjustment and distribution of the air through the room openings.

Mixing dampers, when not automatically operated, should be provided with suitable chains, pulleys, counterweights, etc., arranged for hand operation from the rooms they serve.

Automatic fire dampers should be provided in all ducts passing through a fire wall, and in all room opening connections into a vertical flue which serves more than one room. Such dampers should be controlled by a fusible link, or equivalent device, to insure the releasing and closing of the fire damper in case of fire in such ducts or flues.

*o. Deflectors and diffusers:*

Should be provided for air supply room inlets whenever the location of the air inlet is such as would otherwise produce objectionable drafts or inefficient air distribution in the room. Such deflectors and diffusers should be of approved construction and adjustable. They may be placed behind or at the opening of the register or grille, or may replace such register or grille.

*p. Recirculation of schoolroom air:*

Return ducts, providing for recirculating schoolroom air, should be permitted only as a means of pre-heating. Such ducts should not be used during school sessions, unless the circulated air is first passed through an approved air washer. When this is done, provision should be made for the introduction of not less than twenty-five per cent of outdoor air to be mixed with the washed air.

3. Air supply:

*a.* The ventilation system should be of ample capacity and should be so installed as to supply to every room occupant during the entire period of occupancy the following minimum amounts of clean, pure, warmed outdoor air:

Thirty (30) cubic feet per minute in all rooms used for regular or special class study or recitation, including laboratories, shops, and other special class workrooms.

Fifteen (15) cubic feet per minute in all rooms used for assembly purposes.

The number of occupants for each room should be assumed to mean the seating capacity on the basis of fifteen (15) square feet of floor area for classrooms and seven (7) square feet of floor area for auditoriums for each individual.

*b.* When the number of occupants cannot be determined in this manner, the following rules should govern:

Eight (8) air changes per hour may be substituted in lieu of thirty (30) cubic feet per minute per occupant for rooms used for regular class study or recitation.

Six (6) air changes per hour for laboratories, shops, or other special class workrooms.

Two and one-half (2½) cubic feet of air per minute per square foot of floor area for assembly rooms.

A minimum of four (4) air changes per hour for all other rooms requiring ventilation.

*c.* Every room having air supply ventilation should be provided also with exhaust ventilation. The volume of air exhausted should be at least equal to the volume of air supplied in each case. In domestic science rooms, laboratories, and toilet rooms, the air exhausted should exceed the air supplied so that no pressure may be produced in these rooms.

*d.* Every coat room adjoining a schoolroom should be provided with exhaust ventilation. Schoolroom air may be wholly or partly exhausted through the adjoining coat room. When exhausted wholly through the coat room no other source of heat in the coat room should be required. When schoolroom air is not wholly or partly exhausted through the coat room, the coat room should be heated, and should be provided with exhaust ventilation equal in volume to not less than six (6) air changes per hour.

*e.* Every sanitary and toilet room having more than one watercloset or urinal fixture should be provided with air exhaust ventilation equal in volume to not less than eight (8) air changes per hour. The ducts or flues for such ventilation should be independent of, and separated from, any other part of the ventilating system. The movement of the air in such ducts or flues should be positively maintained, either by means of accelerating heaters in exhaust flues extending through the roof, or by an exhaust fan or other equivalent device. Toilet rooms should be ventilated through utility chambers provided behind the water-

closets or urinal stalls. In such installations, each watercloset stall should be vented and provided with a grille of not less than thirty-six (36) square inches area located about twelve (12) inches above the floor.

*f.* In all chemical laboratories, and in other rooms where strong odors, fumes, or gases are generated, special cabinets or hoods should be provided to confine and carry off such odors, fumes, or gases. Each such cabinet or hood should be connected to a separate system of exhaust ventilation. The movement of the air in such system should be positively maintained, either by means of accelerating heaters in exhaust flues extending through the roof, or by an exhaust fan or other equivalent device.

*g.* A system of air supply and exhaust ventilation should be provided for gymnasiums, natatoriums, shower, lunch, and locker rooms. It is not necessary where the area of movable windows communicating directly with outside air is at least equal to one-sixth of the floor area of the room. In all other cases, air supply and exhaust ventilation should be provided sufficient to maintain not less than six (6) air changes per hour in each such room.

*h.* Where moving picture machines are installed, the enclosures or booths for such machines should be provided with approved independent means of air exhaust ventilation having sufficient capacity to remove at all times not less than sixty (60) cubic feet of air per minute for each machine.

*i. Fresh air intakes:*

The fresh air supply for ventilation should be taken from an uncontaminated source, preferably from above the roof, or at a point at least fifteen (15) feet above the grade level. The air supplied should be free from dust or other impurities. When taken from above the roof, inlets should not be located within twenty-five (25) feet of toilet vents or chimney. Openings should be provided on side away from such toilet vents or chimney.

Intakes should have openings protected with suitable wire screen to keep out birds, vermin, and debris. Approved louvers or doors should be provided to keep out the weather when the ventilation system is not in use.

Intakes should be computed for free area of opening based on:

(1) A maximum allowable air velocity of four hundred (400) feet per minute for a gravity system.

(2) A maximum allowable air velocity of one thousand (1,000) feet per minute for a mechanical system.

Fresh air chambers should be clean at all times and should not be used for storage purposes.

*j. Air filters:*

(1) When used for removing dust or other solid impurities from the air supplied for ventilation, air fil-

ters may be cloth equipment in the form of screens or bags and so arranged as to allow of ease of cleaning and renewal.

(2) When cloth is used as a filtering material, the net filtering area should be computed on the basis of:

(*a*) A maximum allowable velocity of twenty (20) feet per minute for a gravity system.

(*b*) A maximum allowable velocity of forty (40) feet per minute for a mechanical system.

*k. Air washers and humidifiers:*

(1) Air washers are preferred to air filters. Air washers should be equipped with an automatic means for maintaining a relative humidity within the schoolrooms between the limits of forty (40) and sixty (60) per cent.

(2) Air washers should have cross-sectional area based on a maximum allowable velocity of two hundred and fifty (250) feet per minute for a gravity system and five hundred (500) feet per minute for a mechanical system.

4. Fans and motors:

Should be selected for type and capacity on the basis of the relations obtaining between the resistance to be overcome, the volume of air to be delivered, and the speed of operation. They should be so designed, constructed, and mounted in connection with electric motors or other approved motive power, that they will operate quietly and without vibration, with a velocity of wheel at the periphery not exceeding thirty-six hundred (3,600) feet per minute and a velocity of air through the outlet not exceeding two thousand (2,000) feet per minute for housed fans.

5. Distribution:

*a.* The heating system should be of ample capacity and so installed as to insure uniform temperatures being maintained in occupied rooms when the outdoor temperature is zero degrees Fahrenheit, with a variation not exceeding three (3) degrees Fahrenheit, as measured on a plane three (3) feet above the floor as follows:

A maximum of 70 degrees Fahrenheit and a minimum of 67 degrees Fahrenheit in all rooms used for class study, recitation, or assembly purposes (including laboratories, shops, and other special class work rooms).

A maximum of 70 degrees Fahrenheit and a minimum of 65 degrees Fahrenheit in all cloak, sanitary and toilet rooms, corridors, passages, and stairhalls.

A maximum of 80 degrees Fahrenheit and a minimum of 75 degrees Fahrenheit in all shower rooms.

A maximum of 65 degrees Fahrenheit and a minimum of 60 degrees in all gymnasiums and play rooms. All rooms or spaces used for school purposes should be heated. The capacity of the plant

should be such that the maximum temperature requirements as above stated may be maintained throughout the building at all times of occupancy. All rooms not above listed in which the occupants remain at study or at rest should be classed under the 67-degree minimum. Rooms intermittently used for other than class study, recitation, or assembly purposes should be classed under the 65-degree minimum. Rooms used for hard exercise or play should be classed under the 60-degree minimum.

*b. Room openings for ventilation:*

Fresh air inlets should be located:

(1) On an interior wall with bottom of opening approximately eight (8) feet above the floor wherever possible, or

(2) In or near the ceiling where installation conditions necessitate such location.

Exhaust air outlets should be located on an interior wall and preferably in the same wall with the fresh air inlet. Such outlets should be at or near the floor in all rooms provided directly with gravity or mechanical air supply. In rooms not provided with gravity or mechanical air supply, the exhaust air room outlets should be located in or near the ceiling and preferably at a point most remote from the window.

*c.* When schoolroom air is exhausted in whole or in part through an adjacent coat room, the exhaust air outlet in such coat room should be located in or near the ceiling, and preferably at the end of the room most remote from the window. A second opening should communicate between the schoolroom and the coat room so ventilated. This second opening should be located near the floor in the end of the coat room opposite to the above described exhaust outlet. The relation of the two openings should be such as to provide for a continuous air circulation from one end of the coat room to the other end. A door having a screened lower panel or constructed with open space beneath same, may be used for admitting schoolroom air into the coat room. If such provision is not made, a separate opening in the wall should be required.

*d.* For toilet, locker, shower, or coat rooms having only an indirect means for heating, the warm air inlets may be located near the floor, provided the vitiated air is withdrawn from such rooms through outlets located in or near the ceiling.

For a moving picture booth the air exhaust outlet should be located in or near the ceiling and should connect to a special fireproof duct or flue carried to a proper place of discharge out of doors. The clear area of this duct or flue should be based on not less than one and three-fifths square inches for each cubic foot of air to be exhausted. In addition, the flue should be provided with an

adjustable damper made operative from the booth and equipped with an appliance containing a fusible link, or equivalent device, to insure the releasing and wide opening of the damper in case of fire.

6. Temperature control:
   Automatic temperature regulation should be provided for controlling and maintaining the minimum temperature requirements. Such a system should be provided in all principal rooms occupied by the pupils for more or less extended periods. The system should be applied to all direct radiators within rooms and to all indirect radiators or mixing dampers, where the system of heating and ventilation used makes it possible.
7. Special provisions:
   In assembly rooms, the air may be introduced through "mushroom" ventilators located under seats, provided that the vitiated air is exhausted from the room through outlets located in or near the ceiling and in such manner as to provide for continuous "upward" air circulation without objectionable drafts. Chemistry laboratory—exhaust fan to general and student table hoods.

B. Fire Protection System:

1. Apparatus:
   Small hand fire extinguishers should be provided for every 2,000 square feet of floor area. They should be prominently exposed to view and always accessible. Fire gongs with connections to all stories and the basement. Gongs should be centrally located in the main halls and should also be provided in shops, gymnasium, and other rooms where the noise attendant upon the use of the room prevents the hall gong from being heard. Fire alarm stations should be in plain sight and located in halls, principal's office, chemistry, manual training, and household laboratories, and boiler rooms. The arrangement in the principal's office should permit of monthly trials. The school building should be connected with the community fire department alarm system. Automatic sprinkler systems with pressure heads located in the proportion of one to about 100 square feet of floor area. Standard stand pipe system, with no part of building more than 75 feet distant from nearest hose outlet, 2½-inch hose and hose racks and valves exposed in corridors. Metal ash and waste cans should be provided for the storage of waste, sweepings, and paper. For the purpose of burning refuse or waste, wire cages should be used.
2. Fireproofness:
   Score on this item should be based on the construction of building. Can the building be classified under type A, B, C, D, or E? (See definition, page 13.)

3. Escapes:

Where enclosed fireproof stairwells are not provided, the building should be equipped with adequate fire-escapes. Doors at floor levels should open upon fire-escapes. The latter should extend to the ground.

4. Electric wiring:

Electric wiring should be installed according to the latest revised regulations of the National Board of Fire Underwriters.*

5. Fire doors and partitions:

Self-closing fire doors should be placed at all places of probable danger, especially separating the heating plant from the rest of the building. Fire glass windows should be installed in all fire stairwells, and should be required below or overlooking fire-escapes. Rolling corridor fire partitions for the purpose of closing off sections of building at night or during vacations should be provided where needed.

6. Exit lights and signs:

Exit signs of clear bold type should be displayed near fire exits. In buildings used extensively at night, red globe exit lights are necessary.

C. Cleaning System:

1. Kind:

A vacuum system is the standard.

2. Installation:

Large school buildings may be equipped with a vacuum cleaning system with permanent piping so that every part of the building is not more than fifty feet from a hose outlet. In smaller buildings the small portable vacuum cleaners should be provided with base plug connections with the electrical system. Where no vacuum system is provided, measure installation on basis of sufficiency and adequacy of floor brushes, sweeping compound, dust cloths, and other cleansing materials furnished. Proper storage facilities for this equipment should be provided.

3. Efficiency:

For permanent vacuum equipment, hose should be 1¼ inches in diameter, stiffened with spiral wire, 50-65 feet long. Discharge into furnace. Where no vacuum system is provided, measure efficiency on basis of cleanliness of floors, walls, furniture, plenum chambers, toilet rooms, storage rooms, etc.

* For copies of this "National Electrical Code," address National Board of Fire Underwriters, 76 William Street, New York City.

D. Artificial Lighting System:

1. Gas and electricity:
   Gas for stairways corridors, auditorium, and fire exits. Electricity for the the entire building.
2. Outlets and adjustment:
   Outlets—6-9 per classroom; auditorium footlights, rear of stage, sides, ceiling; corridors 20-25 feet apart; at least one for each vestibule.
   Adjustment: Lights placed high enough not to shine in the eyes of occupants; switches near entries, auditorium, stage, and picture lantern booths; each cluster with an individual switch; darkening shades for rooms provided with picture lantern switch.
3. Standard illumination:
   For classrooms, study, and library rooms, 9-foot candles at each desk without objectionable glare or shadows; for auditoriums, 3-foot candles at each seat.
4. Method and fixtures:
   Method of illumination—semi-direct or indirect. Local lighting by lamps placed close to the work is unsatisfactory except for special cases such as the lighting of blackboards, maps, charts, etc. Except in very rare instances, bare light sources should not be exposed to view. They should always be adequately shaded or completely hidden.*
   Fixtures—simple, yet appropriate.

E. Electric Service System:

1. Clocks:
   One for each classroom and in each special room and senior high schools. Clocks should also be provided when necessary in such other places as the main corridor, the janitor's quarters, and the like. Program clocks for junior and senior high schools.
2. Bells and gongs:
   For assembly, dismissal, and firedrill signals. At least one button on each floor for fire signals.
3. Telephones:
   Community telephone connection with the office of principal's secretary, with extension to the principal's office. Intercommunicating house telephone with connections to all departments.

F. Water Supply System:

1. Drinking:
   One automatic bubbling fountain for 75-100 children, wall attached, easy of access to classrooms, playrooms, gymnasium, and playground; placed at varied heights, refrigerating system. Apparatus should prevent children from touching face to same. Should never be located in toilet rooms.

* See Code for Lighting of School Buildings, Illuminating Engineering Society, 29 West 39th Street, New York City.

2. Washing:

Wash-bowls adapted to height of children, located in toilet rooms, teacher rooms, janitor rooms, laboratories, bathrooms. One wash-bowl for every 50 children.

Sinks—located in laboratory, science lecture room, laboratory, instructors' workroom, printing shops, kitchens, drawing rooms, manual training rooms, boiler rooms, and janitor's closets on each floor.

3. Bathing:

Showers easy of access from gymnasium, swimming pool, and playgrounds, number depending upon probable size of gymnasium classes; individual shower stalls and adjoining dressing rooms; canvas curtains for girls; side showers for both boys and girls. Separate valves for hot and cold water. Tub baths adjacent to medical inspection room.

4. Hot and cold water provisions; sanitary soap arrangements; adequate toweling and towel racks.

G. Toilet System:

1. Distribution:

Location and accessibility should be considered. Majority on ground floor; at least one seat for boys and one for girls should be provided for emergency on each floor. Conveniently placed with reference to stairways, corridors, and readily accessible to classrooms. Offices, teachers' rooms, auditorium, gymnasium, dressing rooms, and janitor's quarters should be provided with toilet conveniences. Separate toilets for kindergarten convenient to classroom.

2. Fixtures:

Porcelain seats of open type with individual automatic flush or general flush timed for more rapid action during intermission. Urinals sides and backs of individual stalls of non-absorbent and easily cleaned materials. Back of stall should incline forward toward bottom and receive cleansing spray evenly distributed across the top. Toilet seats should be in compartments with light swinging doors. The seats should vary in height according to the height of the children who attend the school. Different sizes should be segregated. Only non-porous and non-corrosive fixtures should be used in toilet rooms. All fixtures should combine ease and certainty of operation with durability of material. Toilet paper racks should be furnished.

3. Adequacy and arrangement:

The standards for adequacy are as follows:

| | *Elementary school* | *High school* |
|---|---|---|
| Boys' toilet seats | 1 for each 25 boys | 1 for each 33 boys |
| Boys' urinals | 1 for each 15 boys | 1 for each 20 boys |
| Girls' toilet seats | 1 for each 15 girls | 1 for each 20 girls |

Placing of seats and urinals should be such as to avoid obstruction of light. Should be arranged along walls in single rows. Urinals at point nearest door in boys' toilet, seats farthest from door.

4. Seclusion:

Non-communicating, soundproof walls between adjoining rooms provided for the two sexes. Entrance to toilet rooms properly screened. Partitions and swing doors for each seat.

5. Sanitation:

Southern exposure desirable. The window area of a toilet room must be equal to twenty (20) per cent of the floor area. Separate stack, duct, and fan for ventilating purposes; exposed plumbing conforming to state and community regulations and ordinances. Automatic flush, timed or individual automatic. Floors of tile or moistureproof cement overlaid with hard asphaltum. The wainscot should be of a hard, non-absorbent material, white, and readily washable. Ceiling should be soundproof and odorproof. The toilet rooms should be so constructed that the odors therefrom shall not be transmitted into the classrooms and corridors. The sewage disposal system should conform to the most acceptable modern standards.

H. Mechanical Service Systems:

1. Elevators:

A two-story building may need a single freight elevator. For buildings of more than two stories, adequate elevator service should be provided for passengers as well as freight.

2. Book-lifts:

Dumb-waiter type, desirable at both ends of building.

3. Waste-chutes:

Dust waste-chutes two feet square with s[illegible]sing d[illegible]s on each floor.

All these systems must be enclosed and fireproof.

## IV. CLASSROOMS

A. Location and Connection:

Easy of access to exits, stairways, drinking fountains, and toilets.

B. Construction and Finish:

1. Size:

The minimum for elementary schools should be 15 square feet of floor space and 200 cubic feet of air space per child. 22 x 28 x 12 seats 30 pupils; 24 x 30 x 12 seats 40 pupils. Each eleventh classroom may be smaller to provide for a special class of 20 pupils. Height should vary from 18 x 25 to 24 x 32.

The high school classrooms should be arranged with heat and vent ducts along inner walls. Opportunity should thus be given for the expansion from a single classroom to one and one-half, two, or more units without serious changes in construction. The high school building should be elastic and capable of adjustment in meeting reasonable changes in the program.

2. Shape:
   Should be rectangular in shape—windows on the long axis.
3. Floors:
   Should be in good condition, without cracks, checks, splinters, loose boards, or projecting ends. The standard floor is cement overlaid with battleship linoleum; or hardwood, durable, well-joined, and not dust retaining.
4. Walls and ceilings:
   Plastering, finish, texture, condition, picture mold, chair rail, kind and condition of dado should be considered. The standard is hard, smooth, non-glass plaster, with cement plaster for dado, avoiding grooves and ledges. The ceiling should be deadened where "floating ceiling" is used. Metal picture mold.
5. Doors:
   The following elements should be considered: How opened, size, kind, lock, thresholds, transom, number of exits. The standard size for doors is approximately 3 feet by 7 feet, with glass area in upper half. Doors should swing in both directions or open outwards; no thresholds or transoms. The location of all classroom doors in elementary schools should be such as to place them under teacher control. In high school classrooms, where classes pass in as other classes pass out, two doors are necessary, one at either end of the room.
6. Closets and built-in bookcases:
   At least one in each room large enough to provide for supplies, books, globes, and maps when not in use. Located as near the teacher's desk as construction permits.
7. Blackboards:
   Kind, length, width, color, chalk rail, height from floor, surface, quality, condition, and trim should be considered. The standard is highest grade slate or ground glass, dull black. The following dimensions are standard for width of blackboard and heights of chalk rail:

| *Grades* | *Minimum width of blackboard* | *Grades* | *Height of chalk rail from the floor* |
|---|---|---|---|
| 1-3 | 28 inches | 1-2 | 24 inches |
| 4-5 | 32 inches | 3-4 | 26 inches |
| 6-8 | 36 inches | 5-6 | 28 inches |
| High School | 36-40 inches | Hign School | 32-36 inches |

Blackboards should be placed at the front of the room and on the side to the right of the children seated. It is inadvisable to place blackboards between windows. In certain high school classrooms, such as mathematics rooms and commercial rooms, blackboards should be placed on three sides of the room. In elementary classrooms the installation at the rear is unnecessary. A chalk and eraser trough, with an open wire cover of one-fourth of an inch mesh, with hinges or with an easily removable tray, should be placed at the bottom of each blackboard. The inside width of the trough should be 2¾ inches and the depth one-half of an inch above and one-half of an inch below the mesh. Blackboards should be mounted on a firm backing and should have perfectly butted and smooth-shaven joints. Double sliding blackboards in front of classrooms, lecture rooms, and laboratories, and light curtains for covering boards on dark days or when not in use, are acceptable.

8. Bulletin boards:
   Adequate bulletin space apart from blackboards should be provided. This may be located above blackboards or in space not occupied by blackboards. Cork is the most acceptable material.
9. Color scheme:
   The standard color scheme for classrooms is as follows: Walls light buff or very light green or gray; ceiling white or extremely light cream; dado slightly darker than walls; woodwork, furniture, and shades to harmonize in tone; dull finish.

C. ILLUMINATION:

1. Glass area:
   Glass area should be one-fifth to one-fourth area of floor—determined by latitude and by the presence or absence of light obstructions.
2. Windows:
   For regular classrooms in both elementary and high schools, windows should be located only on the long side of the room for left-hand lighting. The head of all windows should be square and close to the ceilings. Windows should be about 3½ to 4 feet from the floor and grouped symmetrically. Plain glass should be used in all sash. Distance between windows should not exceed twelve (12) inches. At front end of the window side of classrooms, 5 to 7 feet of dead wall space should be provided. Clear wire glass should be provided where windows adjoin the fire-escapes. The width of classrooms should be governed by the height of windows. Where rooms are twelve (12) feet high and windows reach approximately to the ceiling, the maximum width of classrooms should be 24 feet. Similar proportions should govern in other instances.

3. Shades:

Translucent shades should be provided all classroom windows. They should be adjustable and should be hung from the center of the windows. Care should be taken to have the color of the shades harmonize with the color of the walls. The preferred color for shades is bisque or light sage. To darken rooms, opaque shades should also be provided.

D. Cloakrooms and Wardrobes:

Elementary schools:

Cloakrooms should provide ample space for winter wraps for each child. They should be under teacher control to prevent thieving. Ventilation away from the classroom should be provided. Umbrella racks are desirable. Cloakrooms should be easily accessible to children and so arranged as to avoid confusion at all times of the day. Cloakrooms should be wide enough to provide sufficient room for ingress and egress without interfering with wraps. The hangers should be so arranged that wraps are sufficiently distant from the wall to provide for free passage of air behind them. The height of hangers should be adapted to the average size of the pupils who are to use them. The heights of children vary approximately as follows:

| | | |
|---|---|---|
| Grade I | 5 year olds | 39 inches to 46 inches |
| Grade II | 6 year olds | 39 inches to 49 inches |
| Grade III | 7 year olds | 40 inches to 52 inches |
| Grade IV | 8 year olds | 42 inches to 54 inches |
| Grade V | 9 year olds | 45 inches to 56 inches |
| Grade VI | 10 year olds | 47 inches to 59 inches |
| Grade VII | 11 year olds | 48 inches to 63 inches |
| Grade VIII | 12 year olds | 50 inches to 66 inches |
| | 13 year olds | 53 inches to 69 inches |
| High School | 14 year olds | 55 inches to 71 inches |
| | 15 year olds | 57 inches to 72 inches |
| | 16 year olds | 58 inches to 72 inches |

High school lockers:

Lockers may be substituted for cloakrooms in junior and senior high schools. Lockers should be grouped in well lighted and ventilated rooms where they can be properly supervised. In a large high school such rooms should be distributed and placed upon the various floors in close relation to the general toilets and study rooms. The placement of high school lockers along corridors should not be encouraged.

E. Equipment:

1. Seats and desks:

Elementary schools:

Should be individual, adjustable, and adjusted. Movable chairs are preferable to screwed down seats.

No double seats, seating two children, are acceptable. In all cases pupils should be comfortably seated.

High schools:

Individual seats and desks should be provided in home rooms adjusted to meet the needs of each student. No double seats and desks are acceptable. Tablet chairs may be used in recitation rooms. The other equipment of high school rooms will vary with the special uses made of them.

2. Teacher's desk:

Substantial, attractive, adequate to needs, not mounted on platform. Preferably size 52 x 32 (approximately) and with body raised from floor to permit of sweeping underneath.

3. Other equipment:*

Elementary classrooms should include much of the following:

| | | |
|---|---|---|
| Aquarium | Knives | Set of measures |
| Bell | Large dictionary | Supply cabinet |
| Bookcase | Maps | Table |
| Bulletin board | Pencil sharpener | Teacher's chair |
| Clock | Phonograph | Thermometer |
| Curtains | Pictures | Umbrella stand |
| Dictionary holder | Pointers | Visitors' chairs |
| Filing cabinet | Projectoscope | Waste basket |
| Flag | Pupils' chairs | Window shades |
| Globe | Sand table | Window stick |
| Inkwells | Scissors | |

Other classrooms, such as kindergarten, science rooms, etc., of both elementary and high schools, should be equipped for efficient teaching service.

## V. SPECIAL ROOMS

The same requirements of lighting, construction, color scheme, swing of doors, and the like, established for regular classrooms, should also apply to the special rooms for elementary and high schools unless there are special requirements to the contrary.

A. Large Rooms for General Use:

1. Playroom:

Playrooms should be provided in all elementary schools. They may be located on the basement floor and be combined with either the auditorium or the gymnasium. One for boys and one for girls should be the arrangement. Playrooms should be accessible to toilets and to playgrounds. Drinking fountains should be provided in immediate locality. Wall benches and wire screens for windows and electric bulbs should be part of the equipment.

* For complete equipment of an elementary school, consult The Strayer-Engelhardt Inventory Book for Elementary Schools, C. F. Williams & Son, Inc., Albany, N. Y.

2. Auditorium:
   *a.* Location, accessibility: Should be on the first floor, accessible from classrooms and main entrance. It should be planned and arranged to serve the school for more purposes than that of a mere lecture room.
      (1) Elementary school: A separate auditorium is not an essential part of a small elementary building where other provision exists for school and community gatherings. Frequently, for the sake of economy, the auditorium and gymnasium, or the auditorium and the playrooms may be combined. Where no other large room is provided in elementary schools, the auditorium should be provided.
      (2) High school: An auditorium should always be included in the plan of a high school. It is best separated from the gymnasium in the larger high schools.
   *b.* Size: The seating capacity of the auditorium should be approximately 60 per cent of the pupil capacity of the elementary school and sufficient to accommodate the entire capacity of the high school. All possible provision for overflaw attendance should exist. Auditorium capacity is determined on the basis of 7 square feet for each individual.
   *c.* Construction: Under this element, floor, acoustics, obstructions, exits, gallery (kind, seating capacity, location, accessibility), finish, and ornamentation, should be considered. The standard is a level floor, with seats in movable tiers. Acoustic properties should be provided for. Depressed floor for orchestra is desirable. Orchestra music stands should be equipped with devices that will completely shut off all light from the audience. Suitable lettering for aisles and the numbering of seats should be provided. Posts and pillars should be eliminated. The indirect system of lighting is preferred in the audience room. Adequate exit provisions allowing vacation of auditorium in 2 minutes. General trend of decoration should be middle value, pure neutral. If light conditions are such that color is desired, modify the neutral slightly with whatever hue is needed.
   *d.* Stage: The front should be 3½ to 4 feet high. The depth of the stage should be approximately the width of the proscenium opening. The width of the stage on either side of the proscenium opening should be one-half the number of feet of the opening itself. In other words, if the opening is 30 feet there should be about 15 feet either side of it in order to have adequate room for assembling participants and moving scenery, lighting purposes, etc. The back of the stage should not be the outside wall of the building, but a wooden partition with passageway at least behind it, or better, sliding doors opening into rooms on the

stage level, which, when the partitions are open, can be used as an extension or in a stage when desired. The stage should be level. The apron should be eliminated. The proscenium arch should have a minimum opening of 30 feet, and be just as low as possible without obstructing the line of vision. Sufficient space above the opening is desirable to allow for the raising of drops. A movable arch is most desirable. Scenery should have a minimum of constructed parts. The combination type of scenery, with pylon sets, curtains, and screens, is most desirable. There should be no steps leading to the stage from the sides or back, but steps leading from the audience room to the stage in sections to be placed across the front from wall to wall. The lighting for the stage should be an overhead direct system, with lamps from the wings. The switchboard should include dimmers and be placed at the right of the stage near the front. If the proscenium arch is a movable one, place the switchboard near the front outer wall. Footlights and border lights should be provided. Electrical buzzer connections with orchestra, dressing rooms, moving picture operator, and light operator, are desirable.

*e.* Dressing rooms: Located on either side of the stage, preferably one for each sex on either side. Equipped with tables, mirrors, and ample clothes-hooks. Easily accessible to toilet rooms and with drinking fountains in immediate vicinity.

*f.* Storage provision for stage paraphernalia.

*g.* Motion picture booth—fireproofed and well ventilated. Proper screen provisions. Stereopticon connections provided.

3. Study hall:

*a.* Elementary schools may need no special study room provisions.

*b.* High schools—These rooms should be limited to accommodate 100 pupils. They should be centrally located, should be convenient to stairways, and should adjoin the school library. In small buildings, the study room and library should be planned so that the teacher in charge of the study room may also supervise the library.

4. Library:

The separate library room, well equipped with books of reference, encyclopedias, standard fiction, acceptable current magazines for boys and girls, as well as for teachers and other adults, with reading tables, chairs, adequate shelving and proper decoration, should be a part of every school.

*a.* Elementary schools: The library should be placed on the first floor near the main entrance with provision for shutting off the library itself from the rest of the building. Its size may vary but in schools of ten classrooms or more the library should begin to take the space of two elementary classrooms.

*b.* High schools: The library may adjoin the study hall or be arranged according to the plan in (*a*).

5. Gymnasium:

*a.* Elementary schools: Separate gymnasiums are not necessary in elementary schools where adequate playrooms are provided. If a gymnasium is not a part of an elementary school, the playrooms should be suitable for use as basketball and volley ball courts, for class calisthenics, rhythmic dances, and similar group exercises. In all cases, elementary schools should be equipped with showers adjacent to the playrooms or gymnasium. A height of at least 16 feet is essential for play purposes in such combinations of playrooms and gymnasiums.

*b.* High schools: The plans for all such schools should include an adequate gymnasium. The minimum desirable size for a small school (500 in enrollment) is 45 feet by 75 feet. All gymnasiums should provide space for a regulation size basketball court, and, when possible, should be planned for two such courts. A high school gymnasium should have a height of at least 18 feet.

*c.* Location: The gymnasium is to best advantage located on the ground level. It should be accessible to the main corridor and to locker, shower, and toilet rooms.

*d.* Construction: Sufficient seating space for spectators of games or exhibits is most desirable. The length and width of the gymnasium should relate as three to two, while the construction of the walls should be of such a nature as to reduce to a minimum the carrying of sound to the classrooms. A wooden floor should always be provided. The walls of gymnasiums are preferably light colored. A maximum of sunlight should be available. The ratio between window and floor area should be 20-25 per cent or more. Three open sides are desirable for the gymnasium.

*e.* The equipment of a high school gymnasium should not be elaborate. It should include a fair percentage of the following:

Athletic record board
Balance board
Balance swing
Bar-bells
Basketball
Bean bags
Benches, Swedish
Bleachers
Boxing gloves
Breast bar
Buck
Cabinets for clubs and bells
Chest bars
Chest weights
Climbing apparatus
Drill guns
Dumb-bells
Flying bars
Horizontal bars
Horse
Inclined plank
Indian clubs
Instructor's platform
Indoor baseball
Jumping boards
Jump mat
Jump stands
Ladders
Lockers
Mats
Mat hooks
Medicine balls
Parallel bars
Piano
Pulley weights
Skipping ropes
Sliding pole
Stall bars
Striking bags
Traveling rings
Vaulting bars
Volley ball
Wands
Wrestling mat
Wrist machine

*f.* As auxiliaries to the gymnasium, the physical director's quarters, showers, locker rooms, and equipment storage are essential. Locker rooms, or gymnasium dressing rooms equipped with lockers, should be provided for all gymnasiums where the program requires a change in attire on the part of pupils. The locker rooms should be sanitary, well provided with natural and artificial light, and well ventilated. Locker rooms and shower baths should be within immediate access of each other.

6. Swimming pool:

Size, nearness to dressing rooms, etc., adaptability, finish, water supply. Provision should exist for frequent and adequate cleansing of the pool, for a continuous and filtered water supply, and for laundering swimming suits and towels.

7. Lunchroom:

This type of special room should be a part of all schools which house children who, because of the distance of their homes from the school, are required to eat their lunch at school. Lunchrooms should be planned in conjunction with the household arts rooms. They should be large enough to accommodate at least one-half of the students of building seating capacity at one sitting. The equipment of lunchrooms may vary to meet the needs of various types of schools. In the smaller schools, tables, chairs, and provisions for heating and cooking food are needed; in the larger schools, a more elaborate equipment, including self-serving counters, a guide rail, drinking fountain, tables and chairs are required. Although the lunchroom is used only a fractional part of the school day, the lighting, ventilating, and decorating of the room should be satisfactory.

B. Rooms for School Officials:

1. Officers:

A principal's office should be provided in all schools of this group. It is preferably located on the first floor beside the main entrance. In small elementary schools, the office should consist of one large room which should also serve the Board of Education for its meetings. In high schools, the office should consist of a suite of rooms, comprising reception room, smaller private office with vault, a clerk's room with filing cabinets, storage room for school supplies and text-books, and a coat room with adjacent toilet.

2. Teachers' rooms:

Size—18 x 24, one each for men and women. Should include toilet facilities, a couch, provisions for heating food, hot and cold water, cloak room facilities, preferably individual lockers, magazine racks, and bookcases. Work table or individual work desks are desirable.

3. Nurses' rooms:
   Location, size, equipment, and toilet facilities (including bath), sanitation, and finish should be considered. Number and facilities dependent on size of school and school system. The nurses' room should be provided with sliding partitions so that a division into two or three rooms becomes possible. The equipment should include that of a complete school dental clinic, a medical clinic, and the materials needed by a school nurse in her daily work. The medical room should be located adjoining the office where all pupil records are kept. A tub bath should be installed in connection with the medical equipment.
4. Janitor's room:
   Conveniently located near boiler and toilet rooms. Equipped with wash basin, sink, and individual bath. Telephone and office supplies should be furnished.

C. Other Special Service Rooms:

1. Laboratories:

*Elementary schools**

*a.* Household arts rooms:
The household arts equipment in elementary schools should consist of cooking and sewing rooms. It should be the aim in these rooms to reproduce desirable home conditions. Adequate and high-grade utensils should be provided. Sewing rooms should be equipped with special sewing tables, lockers, and chairs. Both of these rooms should be equipped for approximately twenty pupils.

*b.* Industrial arts rooms:
The industrial arts equipment for elementary schools should be housed in a room approximately 21 feet by 45 feet or larger. Provision should be made for twenty pupils. A separate tool room and stain room are necessary for manual training work. A storage and drying room for lumber is essential. A sink and washbowl should be installed in this room.

*c.* General science rooms:
When provided in elementary schools, they should be of the same size as ordinary classrooms with chairs and tables for equipment. Shelves should be installed for reference books and storage. Running water should be provided.

*High schools*

*a.* Household arts department:
The number of rooms required in the household arts department of high schools and the size of such rooms vary. The first standard in the equipment of these rooms is that desirable home conditions should be imitated as far as possible. Besides the cooking and sewing rooms essential in elementary schools, a complete housekeeping suite, comprised of bath, dining room, living room, and bed room is desirable. A fully equipped laundry is frequently desirable.

* For the essential equipment of these rooms consult The Strayer-Engelhardt Elementary School Inventory Book, C. F. Williams & Son, Inc., Albany, N. Y.

*b.* Industrial arts department:
Shops should be so constructed as to permit of the most rapid expansion. The space provided for this work should be adapted to a flexible program. Power and light should be readily accessible, and hence the rooms may to best advantage be located in the vicinity of the school power and fuel plant.

*c.* Biological and general science laboratory:
This laboratory should be housed in a room approximately 24 feet by 32 feet. It should be equipped with tables, chairs, running water, cabinets, and storage shelves, and the other materials needed in such workshops.

*d.* Physics and chemistry laboratories:
In smaller high schools, separate rooms are necessary and should be planned en suite with a lecture room between them. These laboratories, as well as the lecture room, should be supplied with their special equipment. Fireproof storerooms or supply rooms, in which chemicals are stored, should be provided. The proper ventilation of the chemical laboratory should be assured.

*e.* The commercial department:
High schools which offer commercial courses should have special rooms with special equipment for typewriting, bookkeeping, and other branches.

2. Lecture rooms:
Connected with and centrally located with respect to science laboratories in high schools. Instructor's fully equipped laboratory table with pupils' seats arranged in ascending tiers.

3. Storage and supply rooms:
*a.* An adequate number of such rooms should be provided in all buildings. Storage facilities should be provided all departments in close proximity to the office or most important room. These rooms should have natural lighting, where possible, and should also be provided with artificial light.

*b.* Bicycle room: Bicycle rooms should be placed in the basement of all buildings to which children come in relatively large numbers on their bicycles. These rooms should be immediately accessible from the school ground, equipped with bicycle racks and all screened in or enclosed that the room may be securely locked. Where necessary, bicycle inclines should adjoin the stairways leading to these rooms.

4. Studios:
Here should be included drawing, art, and music rooms. They are not essential in elementary schools, but desirable in large high schools. Special equipment is required in such rooms.
Mechanical drawing rooms should be located in close proximity to the boys' shops. North light is preferred for drawing rooms. In all cases the percentage between window area and floor area should be as high as the class room standard.